

Title: The All-Star, All-Sports Course

Brief Overview:

Students will use different types of sports balls to perform a variety of tasks. Students will work on logic problems and create a data table. As a culminating activity, the class will design a sports course that requires application of ratio and proportion, measurement, and principles of friction and Newton's Laws.

Links to NCTM Standards:

- **Mathematics as Problem Solving**

Students will solve logic problems by arranging the sports balls in order of size. Students will determine the size of the holes on the course relative to the type of ball they are assigned.

- **Mathematics as Communication**

Students will write a proposal to the Play Ball Board of Directors describing their putting green.

- **Mathematics as Reasoning**

Students will justify how they determined the size of their sports course hole and the type of putting surface they have selected.

- **Mathematical Connections**

Students will demonstrate their ability to apply mathematical skills to the construction of a miniature sports course.

- **Number and Number Relationships**

Students will demonstrate their ability to calculate ratio and proportions to determine the appropriate size of the sports course holes.

- **Computation and Estimation**

Students will demonstrate their ability to calculate the diameter of various sports balls. Students will also demonstrate their ability to calculate the mean of a set of data to determine par for their putting green.

- **Patterns and Functions**

Students will create a data table to display circumference and diameter.

- **Statistics**

Students will demonstrate their ability to collect, organize, and display data.

- **Measurement**

Students will demonstrate their ability to measure the circumference of a sports ball and determine its diameter. Students will demonstrate the relationship between linear measurement and circumference. Students will create a scale drawing of an authentic situation involving measurement.

Grade/Level:

Grade 6 - 7

Duration/Length:

This lesson will take approximately 7-10 days to complete.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Creating a data table
- Measuring circumference and calculating diameter
- Calculating the mean of a set of data
- Friction and Newton's Laws

Objectives:

Students will:

- make accurate calculations using appropriate units of measurement.
- apply knowledge of ratio and proportions.
- determine circumference and diameter of a sphere.
- work cooperatively to solve problems to design and construct their sports course hole to make a scale drawing.
- calculate the mean to determine par for their golf course hole.
- write a proposal to the Play Ball Board of Directors describing their putting green.

Materials/Resources/Printed Materials:

- Various types of sports balls (tennis, ping pong, lacrosse, racquetball, baseball...)
- String and meter stick
- Objects for obstacles
- Sentence strips for creating holes
- Variety of clubs (hockey stick, bat, lacrosse stick, ...)
- Putting surfaces (blacktop, grass, carpet...)
- Calculator, graph paper, ruler
- Student Packet

Development/Procedures:

Using the packet provided:

- Introduce the lesson - Logic Worksheet "Let the Games Begin".
- Students will measure the circumference of the sports balls using the string and meter stick.
- Students will calculate the diameter of each ball.
- Students will create a data table to organize the circumference and diameter of each ball.
- Place students in groups, give each group one ball. Students will calculate the mean circumference for their ball. (Each group should be given a different type of ball, i.e., tennis, ping pong, lacrosse, racquetball, baseball...)
- Teacher will use the golf ball to show the relationship between the diameter of the ball and the diameter of a golf course hole. (See reference guide)
- Students will measure circumference and calculate the diameter of their sports course hole.
- Students will create the putting green for their ball.

- Students will use the measurements from their putting green to develop a scale drawing. (Depending on the level of your students, you may wish to have them design the scale drawing first.)
- Students determine par for their sports course hole by calculating the mean of their group's trials.
- Students will write a proposal to the Play Ball Board of Directors describing their putting green.

Performance Assessment:

- “Let the Games Begin” worksheet will be completed individually and assessed with the scoring key.
- Student packet with questions 1-9 will be completed as a group activity will be assessed with the scoring rubric.
- The scale drawing portion of the proposal will be completed individually and assessed with the scoring tool.
- The proposal to the Play Ball Board of Directors will be completed individually and assessed with the scoring rubric.

Extension/Follow Up:

The following activities may be used as an extension to reach the multiple intelligences of your students:

- Jingles for the new sports course
- Newspaper articles or radio interviews with student architects of the sports course
- 3-D scale model of entire course
- A TV/radio/newspaper advertisement
- Scatter plot of diameter of sports balls vs diameter of holes
- Guest speakers - architect, golf course manager

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LET THE GAMES BEGIN

Using the following clues, color and label the balls.

Kinds of balls: Tennis
 Golf
 Ping pong
 Lacrosse
 Baseball

The yellow ball is larger than the green ball.

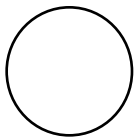
The orange ball is smaller than the blue ball, but larger than the white ball.

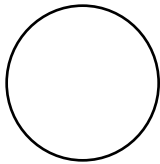
A golf ball is 0.18 inch wider in diameter than a ping pong ball.

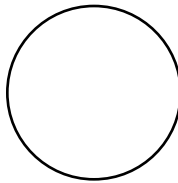
The diameter of a lacrosse ball is 0.3 inch wider than that of a tennis ball and a baseball ball is 0.25 inch smaller than a tennis ball.

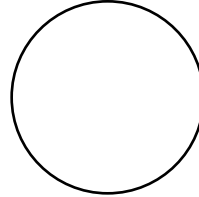
There are two balls smaller than the white ball.

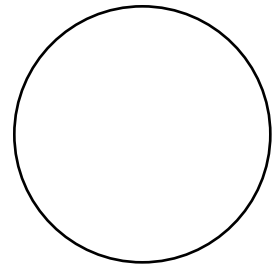
Label each ball with the correct color and write the name of each ball on the line under it.











THE ALL-STAR, ALL-SPORTS COURSE

Congratulations! **Play Ball Corporation's** board of directors, Venus Williams, Tiger Woods , and Cal Ripken, has asked you to create a new form of family entertainment, "The All-Star, All-Sports Course". This course is similar to a miniature golf course, but each hole uses a different type of sports ball.

Your group will be responsible for designing one putting green for the course. Your knowledge of circumference and diameter, as well as friction and Newton's Laws, will be useful in completing this task.

1. Using a string and meter stick find the circumference and calculate the diameter for each sports ball. (Don't forget $\pi = 3.14$ or $22/7$)
Show your work here.

2. Use the space provided to create a data table to organize the circumference and diameter for each ball.

DATA TABLE

Ball	Circumference	Diameter

3. Choose the type of ball your group will use for its sport course hole. Determine the circumference _____ and diameter _____.

4A. The diameter of a golf ball is 4.5 cm and the diameter of a golf course hole is 10.8 cm. Use that ratio to calculate the diameter of the sports course hole for the ball you were given.

$$\frac{4.5 \text{ cm}}{10.8 \text{ cm}} = \frac{\text{the diameter of the sports ball}}{\text{the diameter of the hole}}$$

B. Explain how your group determined the diameter of the sports course hole for the ball you were given.

5A. You will be given a sentence strip to make the hole for your putting green. Using the answer from number 4, calculate the circumference of the hole.

B. Describe how your group determined the circumference for the hole on your putting green.

6. With your group, use the ball you were given to design a putting green and hole for the sports course.

- All putting greens must be 1 meter wide.
- The putting green must be 3-6 meters in length.
- The hole will be a circle formed from the sentence strip(s) and must be in proportion to the diameter of the ball.
- You may choose the surface of your putting green.
- You must have at least one obstacle for the ball to go over, under, around, or through.
- You may choose the type of "golf club" (i.e., golf club, field hockey stick, lacrosse stick, ice hockey stick, bat...) that works best for the type of ball you have been assigned.
- The starting point must be clearly marked.
- The ball must roll on the surface of the putting green.

7. What type of surface did you choose for your putting green? Explain.

8. How long is your putting green? Explain why you chose this length.

9A. Test your putting green. Calculate par for your putting green. Show work.

Par for our sports hole is _____.

B. Describe how your group determined par for your putting green.

Proposal to the Board of Directors:

Play Ball Corporation's Board of Directors has asked you to present them with a written proposal describing your unique putting green for **"The All-Star, All-Sports Course"**. Your presentation will need to include the following information:

- A scale drawing of your putting green on graph paper
- A written description which includes:
 - the type of sports ball you used
 - the type of club you chose
 - the dimensions of the putting green including diameter of the hole, as well as length and width of putting green
 - the obstacle(s) found on your putting green
 - the type of putting surface, justify your choice
 - par for your putting green and how you determined that it is reasonable

REFERENCE GUIDE

To determine the diameter of each ball, students should divide the circumference of each ball by (3.14.) Their answers should approximate the following measurements:

TYPE OF BALL	DIAMETER (in cm) of ball	DIAMETER (in cm) of hole
Ping pong	3.94	9.5
Golf	4.5	10.8
Tennis ball	6.75	16.1
Lacrosse ball	6.56	15.7
Baseball	7.5	18.0
Racquetball	5.95	14.5

A golf ball measures 4.5 cm in diameter .
The actual hole is 10.8 cm in diameter.

Depending on the level of the class, students may use the ratio

$$\frac{4.5 \text{ cm}}{10.8 \text{ cm}} = \frac{\text{the diameter of their sports ball}}{\text{n (the diameter of the hole)}}$$

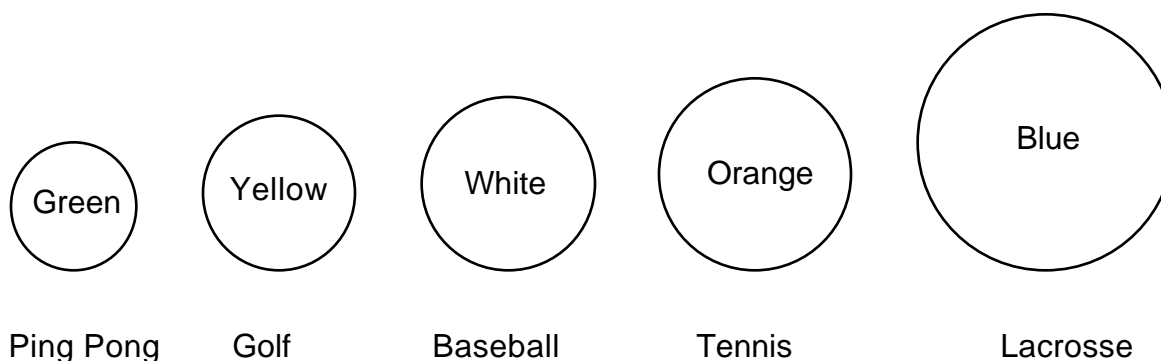
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students may round their measurements so that the diameter of the hole is 2 - 2 1/2 times the diameter of the ball.

Sources: The Balls of Spring , The Sun, March 27, 1997.
Spalding, Book of Rules, Masters Press,1993.

ACTIVITY ANSWERS and RUBRICS

LET THE GAMES BEGIN



SCORING KEY

There are 10 correct responses for this activity (5 colors, 5 labels).

- 3 POINTS All responses correct
- 2 POINTS 7-9 correct responses
- 1 POINTS 1-6 correct responses

SCORING RUBRIC FOR STUDENTS ACTIVITY PACKET

- 3 POINTS All questions completed with detailed explanations
- 2 POINTS Most questions completed with little explanation
- 1 POINT Few questions completed with little explanation

SCORING TOOL FOR SCALE DRAWING

Total possible points for scale drawing = 6

- 2 POINTS Hole, obstacle, and starting point are placed correctly and labeled
- 2 POINTS Scale drawing is drawn to the correct scale
- 1 POINT Scale drawing is labeled with a reasonable scale
- 1 POINT Scale drawing is drawn neatly on graph paper

SCORING RUBRIC FOR PROPOSAL

4 POINTS

All requirements of the proposal are completed accurately.
Proposal is well-written with correct spelling and punctuation.
All measurements are labeled correctly.
Proposal is written in a logical sequence.

3 POINTS

Most requirements of the proposal are completed accurately.
Proposal is written clearly with few errors in spelling and punctuation.
Most measurements are labeled correctly.
Proposal may not be in a logical sequence.

2 POINTS

Some requirements of the proposal are completed accurately.
Proposal is understandable with some errors in spelling and punctuation.
Some measurements are labeled correctly.
Proposal may not be in a logical sequence.

1 POINT

Few requirements of the proposal are completed accurately.
Proposal is difficult to understand with many errors in spelling and punctuation.
Few measurements are labeled correctly.
Proposal may not be in a logical sequence.